Canadian Journal of PUBLIC HEALTH

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Anne M. Collins, Grace Craig, Elizabeth Zaimen and T. E. Roy

INDUSTRIAL HEALTH SERVICE IN KITCHENER
Peter H. Nash

REHABILITATION NURSING
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TWENTY-SECOND ANNUAL CHRISTMAS MEETING LABORATORY SECTION CANADIAN PUBLIC HEALTH ASSOCIATION
Montreal, December 13 and 14, 1954

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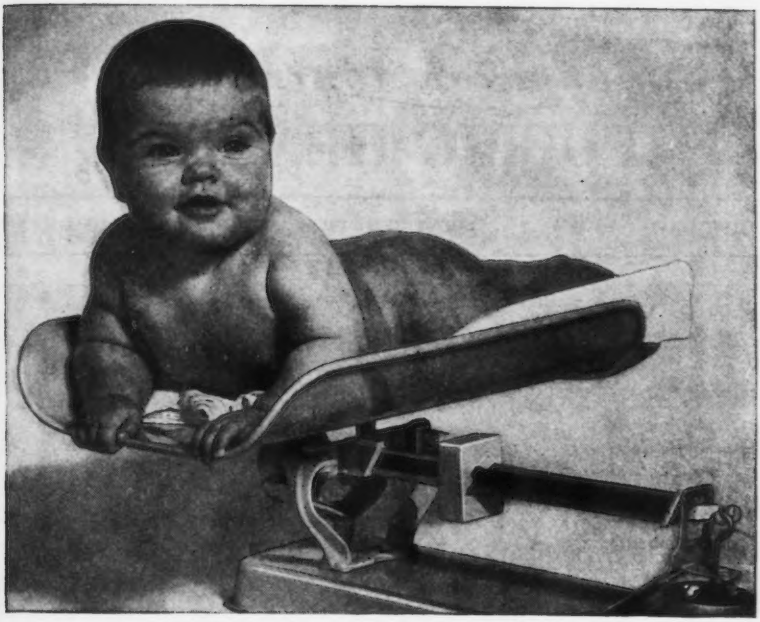

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Canadian Journal of
PUBLIC HEALTH

VOLUME 45 TORONTO, OCTOBER 1954 NUMBER 10

Presidential Address

THEO. J. LAFRENIERE, B.Sc.A., I.C., M.Eng., Dr.Sc., P.Eng.
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Montreal, Quebec
President, Canadian Public Health Association
1953–1954

I WISH to express my gratitude to the members of the Canadian Public Health Association for having elected me President of the Association at the forty-first annual meeting, held in Toronto last October. A great honour was bestowed upon me by your Executive Council, but I fully realize that I am only the recipient of the mark of appreciation of the work that has been accomplished by sanitarians and engineers in the field of public health. The Sanitation Section, to which we belong more directly, is only one of the twelve sections in which the membership is divided, and representing the various activities of the Association. In his presidential address last year, Dr. Defries, who has been the mainstay of our Association for many years, stressed the necessity of "Partnership in Public Health." In his brief review of the history of the Association, he shows very clearly that the Association has been maintained only through the devotion of a few leaders that could group around them public health workers of various professions or training. The Association owes a great deal to the School of Hygiene of the University of Toronto, and more particularly to its Director.

The Sanitation Section was first organized as a Sanitary Engineering Section, and later, if I remember correctly, as a Public Health Engineering Section. Its activities were few, and the membership too limited. The engineers composing it were mostly interested in water supplies, sewerage and nuisances. These problems were very important at the time, but were considered more as engineering problems, although they constituted the most

Presented at the forty-second annual meeting of the Canadian Public Health Association, held in the Château Frontenac, Quebec, May 31–June 2, 1954.

important field in environmental sanitation. Our secretary, Dr. Mosley, recalled in the report of the Executive Committee for 1952–1953 that the original object of our Association was the "dissemination of the knowledge of sanitation in all its branches."

Health conditions were so bad in England more than a century ago that the Government appointed several commissions to study the causes and recommend remedial measures. Edwin Chadwick, a lawyer, was the reporting secretary of many of these commissions. He found that the highest death rate, more than 20 per thousand, or one in fifty as it was then expressed, occurred where the sanitary conditions were poorest, i.e., bad drainage, bad sewerage, bad water supply, and accumulation of filth. He stated that epidemics of contagious diseases were caused or propagated by atmospheric pollution produced by decomposing animal or vegetable substances, damp and filth and crowded dwellings—and that the frequency of such diseases is abated when such conditions are remedied. Dr. Southwood Smith very ably expressed the same idea in the following statement: "Wherever the commissioners of sewers have not been, there fever is prevalent; and, on the contrary, wherever they have been, there fever is comparatively absent." These reports were based on statistical studies of deaths in various parts of England.

Chadwick was not so successful in the application of the recommendations. He created much resentment, especially among the engineers and surveyors. His theory on the design of sewers did not quite agree with the facts.

In 1874, the Rivers Pollution Commission of England stated in its Sixth Report that the "existence of specific poisons capable of producing cholera and typhoid fever is attested by evidence so abundant and strong as to be practically irresistible. These poisons are contained in the discharges from persons suffering from these diseases." It had been observed that sewage-polluted waters could be the cause of disease, but foul air was also considered dangerous.

The same report contained this historical statement well known to sanitarians: "There is no river in the United Kingdom long enough to secure the oxidation and destruction of any sewage which may be discharged into it, even at its source."

The studies made in England were closely followed in America. The State of Massachusetts, where sanitary conditions resembled those prevailing in England, became a leader in sanitation on this side of the Atlantic. It appointed the famous Lemuel Shattuck Sanitary Commission in 1849. The report published in 1850 has been judged by Dr. C.-E. A. Winslow to be one of the most remarkable documents in the history of public health. He further stated in the foreword he wrote for the reprint of the report, in 1948, sponsored by the American Public Health Association and other associations, that it still had its message for us to-day.

Shattuck was a bookseller and publisher; he was also the founder of the American Statistical Association. The fifty recommendations made in the report show the close relation between vital statistics and sanitary conditions or the environment. A rapid survey of these recommendations will enable us to appreciate what has been done in the field of public health, and what remains to be done.

The report recommends a General Board of Health composed as follows: two physicians knowing sanitary science; one counsellor-at-law; one chemist and one civil engineer; two other persons of good judgment capable of investigating and understanding the principles of sanitary science—a good definition for the sanitarian of to-day.

A further recommendation is to the effect that the orders and regulations are to be carried out in a conciliatory manner, and that compulsory process is to be used only when necessary. In order that the health officers be well informed, the report recommends the purchase of books for the use of the local Boards of Health. Today, this might be interpreted as at least a copy of the Canadian Journal of Public Health on the desk of every health worker, as desired by Dr. Defries.

Atmospheric pollution was considered as having a bearing on health, although the knowledge of air pollutants was not well understood. It was based mostly on the conditions of the air surrounding London which contained the emanations from heaps of rotting filth and sewage in the Thames river. The air contained zymotic matters which could cause epidemics, and mention is made of sporules or organic cells as the cause of disease. Town planning was considered important, in order to assure ample provision for a supply of light, air and water, and for proper drainage and sewerage. The object was to obtain cleanliness. "Without a system of drains, a large supply of water is rather injurious; yet without a plentiful supply there can be no drainage at all." This principle still applies today. The sewerage system is the complement of the water-works, and the water-carriage system cannot operate without an adequate water supply.

Nuisances were divided into public nuisances affecting the community, and private nuisances affecting the rights or the property of individuals. Regulations should be made so that no person should prevent any other person from the free enjoyment of life and health. A very sound recommendation indeed, and a good many nuisances would never be created if the rights of the individuals were respected. Smoke from manufacturing plants was considered a great nuisance to the neighborhood, and supposed to be deleterious to health.

The disposal of refuse and sewage from towns received due consideration. It was recommended that they be collected and applied to the land. Brood irrigation has not been successful, although the conditioning value of sludge removed from sewage is better recognized. The composting of garbage is again considered favorably.

The food problem was considered more in the light of adulteration than in sanitary production and handling. This aspect of the problem was left to modern sanitation.

The report would not have been complete without a reference to nursing. It is recommended that institutions be formed to educate and qualify nurses. Quoting from the recommendation: "Nursing often does more to cure disease than the physician himself; and, in the prevention of disease and the promotion of health, it is of equal and even of greater importance." I leave the responsibility of the statement to Lemuel Shattuck, but he also adds that the nurse should follow the directions received, and not be of "improper disposition."

Persons should also be specially educated in sanitary science, as preventive advisers as well as curative advisers, the object of sanitary science being to teach people the causes of disease; how to remove or avoid these causes; how to prevent disease and live without being sick. It could be the program of a School of Public Health.

A State Board of Health was created in Massachusetts in 1869. It had advisory rather than executive functions, and one of its first circulars contained this declaration of rights as regards public health: "We believe that all citizens have an inherent right to the enjoyment of pure and uncontaminated air, water and soil—that no one should be allowed to trespass upon it by his carelessness or his avarice or his ignorance." These high ideals could not be put into force, and numerous recommendations contained in subsequent reports of the Board show that its work remained educational in nature for several years.

In Canada, public health measures were taken at times of epidemics only, through a Central Board which Parliament could appoint. The English practice of creating local boards of health was largely followed. Sanitary conditions were better than in England and Europe, due to our small population scattered over a large territory.

Modern sanitation began with the creation of Provincial Boards of Health in Ontario in 1882, in Quebec and New Brunswick in 1887, and later in the other provinces. The powers granted were of an advisory character at first, but it was soon felt that more than persuasive action would be necessary to secure better co-operation from the local boards of health.

In 1895 the Boards of Health of Ontario and Quebec required that plans of water supplies and sewerage systems be submitted for approval; however, in 1908 sanitary engineering divisions were created in order to secure better control of new works, and to apply remedial measures to some of the previous works. Sanitation in those days consisted primarily in the proper maintenance of these two essential public services. Professor Earle B. Phelps, in his book "Public Health Engineering", published in 1948, states: "The sanitary engineer, through his professional activities, has delimited his field, not as the engineering of the sanitary science, but as the engineering of water supply and its complement, sewage disposal."

Later, milk pasteurization was recognized as an important measure of protection against animal diseases transmissible to man, and it took many years of study before satisfactory equipment could be designed. In 1927—and I have special reasons to remember the date—efficient flush valves on holding tanks were still discussed. It was also accepted that man could contaminate milk.

The abatement of nuisances was also an important part of sanitation, and this work was done by the much-abused sanitary inspector, who was then an inspector of nuisances. The disposal of garbage was also a problem that received some attention in the larger communities, but was sadly neglected in the small centres.

During that period, preventive medicine made great progress and became the important factor in public health. The prevention and control of contagious

diseases have reached a degree where some of these maladies have practically disappeared. However, the change in the age distribution of the population has created new problems for the medical officer.

The conception of environmental sanitation has also changed gradually, requiring better qualified sanitary inspectors, or sanitarians, as they are now designated. Educational facilities for the inspector did not really exist until our Association established a program for the certification of sanitary inspectors. The Manual for Sanitary Inspectors has been most useful, and in the 18th annual report of the Committee on Certification, it is stated that 872 inspectors have obtained the Certificate in Sanitary Inspection (Canada). Formal courses of instruction for the sanitary inspector have now been organized by the School of Hygiene of the University of Montreal, and by the Departments of Health of Manitoba and Ontario.

The field of sanitation has broadened. The public is better educated. It requires better control of its environment. Adequate water supplies and sewerage facilities are accepted as matter of fact. Clean food, and especially safe milk, are expected from all dispensers. Clean air and clean rivers are also required by our population. Cleanliness has become the pass word and the industry has accepted it. Co-operation is easily obtained. As an example of the changes which have occurred, the Milk Distributors Association of Quebec has requested more frequent visits of the inspectors, and also a modern provincial milk by-law.

In order to profit by this popular demand for a better environment, we require a better trained personnel. The sanitary engineer had to become a public health engineer, and I feel that the sanitary inspector should be given the facilities to become a sanitarian. Various reports have been made on what should be such a program of studies. The expression "sanitary science" is very broad, but for the sanitarian it should comprise physics and chemistry, biology and bacteriology, applied chemistry and bacteriology for the examination of air, water and food, epidemiology for a better control of infectious diseases, and health education. Our Canadian universities could develop such a curriculum.

The inspector is in constant contact with the population, advising on sanitary measures and explaining their necessity. His functions make him an educator. Better trained inspectors in key positions would render great service and give to the public the better sanitation that it requires. Permit me to conclude with this statement of Dr. Rosenau on preventive medicine: "When young men have vision, the dreams of old men come true." I believe that it can be applied to sanitation.

Rehabilitation Nursing

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EVERY year a large number of men and women become disabled by illness, congenital defects and accidents, who would benefit from rehabilitation services.

Let us consider the nurse's role in rehabilitation, first from the broader aspects and then from the point of view of the public health nurse.

Rehabilitation is a part of nursing, fundamental to all types of nursing services provided for patients in the hospital or the home. Many conditions or disabilities following which patient-rehabilitation is necessary, can be prevented. Therefore, public health nurses in all types of programs have a role to play in rehabilitation nursing.

Rehabilitation used to be thought of as a process or program designed to restore a disabled or handicapped individual to self-supporting or independent capacity. It was considered something apart from nursing, a specialized process carried on after the need for nursing care was over. Today rehabilitation has a broader meaning; it takes into consideration individual limitations and capacities. Today rehabilitation may be defined as a program or process designed to teach the ill or disabled to live a satisfying, wholesome and useful life adjusted to his individual maximum capacity, keeping in mind that his maximum capacity may be a satisfying, useful life in bed, in a wheelchair, on crutches or on his feet.

To achieve maximum capacity, the rehabilitation process must begin at the onset of illness or injury. Nurses have an important role in the program of rehabilitation. It is a co-operative, supporting role that begins with the nurse's first contact with the patient. For the public health nurse this first contact may be in the home, clinic, school or industry and may occur at any point of the patient's illness, convalescence or recovery.

Rehabilitation nursing is based on four major objectives:

1. The prevention of unnecessary complications or further disabilities.
2. The maintenance of a desire and a physical readiness for increasing activities.
3. The promotion of self-help activities.
4. The preparation for ambulation if it is possible to achieve.

Some may think that these major objectives of rehabilitation nursing are not fundamental to all types of nursing service, or even that they are applicable only to nurses providing bedside care. Let us challenge these thoughts.

Presented before the Public Health Nursing Section at the fifth annual meeting of the Ontario Public Health Association, held in the Royal York Hotel, Toronto, September 23 and 24, 1954.

Let us take the first major objective, to prevent unnecessary complications and further disabilities. The nurse in meeting this objective applies the principles of good posture and body mechanics to patient care or supervision. Unnecessary complications or further disabilities may be the result of contracted muscles or of stiff joints. These can be prevented by maintaining muscle tone and free joint motion.

For the application of this principle we can take for example the nurse visiting a child home from school with suspected rheumatic fever. He is in bed but is allowed activity. His reading material, play equipment, drinking water, etc., are on a bedside table at the right of the bed. Only limited motion is necessary to reach what he requires. The nurse with our rehabilitation nursing objective in mind would suggest to the mother that the table be placed on alternate sides of the bed, to encourage more shoulder and elbow joint motion and also to prevent a possible deviation in the spinal curve. Then, too, a bed tray on which play material was placed could be used. The nurse would have other suggestions to make; for example, the child's feet should be supported by a board or box to prevent foot drop, his legs should be alternately flexed and extended and supported in flexion or extension. For rest periods he should be placed in an easy, natural lying position with support provided to relieve strain on any body part. The main objective is to maintain normal body alignment.

We could apply the same principles to a tuberculosis patient still on a rest regime, to an old, debilitated grandmother, in the household visited because of the new baby, or to a father back to work in a walking cast. We are family health counsellors and our opportunities are many. We could take each of the major objectives in turn and apply all to a work situation. This can be done on the job, in the homes, clinics, schools, industries, wherever the ill or disabled happen to be.

Before leaving this aspect of rehabilitation nursing, consider for a moment the third objective, to promote self-help activities; in other words, to encourage the patient to do as much for himself as possible, still keeping in mind his limitation. Lack of proper interpretation has made this rehabilitation objective one of the bases for criticism of modern nursing.

We all know that not very long ago when a patient was in bed following an operation, an acute illness, or even a long-term illness, everything was done for him. He was bathed, fed, he was cared for in every detail, long beyond the time when he could have assumed some responsibility for his own care. Today, he is still cared for, he is bathed and fed when necessary, but he is encouraged to do as much for himself as he can. This self-care or self-help is part of the plan for his rehabilitation. Activity and movement results in flexible joints and maintains good muscle tone.

Many a patient resents or criticizes the nurse who suggests that he bathe or feed himself. We have heard it said that modern nurses are lazy and inefficient. It is not always realized that it often takes more skill and time to teach a person to do something for himself than it would take the nurse to do it for him.

Interpretation of self-help activities, motivation and encouragement are necessary to prevent patient frustration and resentment. Nurses in hospitals

and in the community might assume more responsibility for better interpretation of self-help activities in modern rehabilitation nursing.

Rehabilitation aspects of nursing plan for progress, not regression; optimism, not pessimism; independence rather than dependence, and normal rather than abnormal living.

So much for the fundamentals of rehabilitation in nursing service. Let us now look at the preventive aspects. We have said that many conditions or disabilities necessitating patient rehabilitation can be prevented.

How can we assist or how are we assisting in the prevention of crippling conditions or disabilities?

1. By aiding in the development and maintenance of good posture for all individuals under all conditions.
2. By assisting in the prevention of the spread of infectious diseases which may cause crippling conditions, for example, poliomyelitis, tuberculosis.
3. By early recognition and correction of physical defects.
4. By assisting in the prevention of accidents, by recognizing and correcting accident hazards in the home, the school or the place of employment.

For many years public health nurses have been assisting in the prevention of crippling conditions or disabilities. The nurse's contribution in the control of communicable disease and in the prevention and correction of physical defects is recognized. Could we extend our teaching in relation to posture and accident prevention to include the principles of body mechanics?

Teaching the correct use of the body to avoid strain and injury is important in the public health nurse's service to the prenatal or postnatal patient, to the school child, and to the worker in industry. All individuals under all conditions should learn to apply the principles of good posture and body mechanics in daily life.

How many of our prenatal or postnatal patients or how many housewives know that there is a correct way for reaching, stooping or lifting? The correct way lessens strain and fatigue.

Are workers in industry being taught the correct way of pushing, pulling or lifting heavy objects? The large muscles of the lower extremities can be used to propel the body in pushing or pulling activities and to raise or lower the body to the best working level. Many industries today are teaching workers the correct position of the body in pushing, pulling and lifting activities and have scientifically planned the placement of working equipment to prevent strain and fatigue.

School authorities are aware of the importance of the proper height of desks and seats in maintaining sound posture and in maintaining maximum mental alertness by preventing fatigue and strain.

But what of the household facilities? We have all seen the weary housewife washing dishes at a sink or working at a table too low or too high for good posture. Have we suggested to her that she stand on a sound, steady box or sit on a stool while she carries out her activities at the sink or table?

We have also seen the preschool child sitting uncomfortably in an adult chair. Have we suggested to the mother ways of adapting the chair to meet the needs of the child for support and comfort?

Good posture and body mechanics prevent strain on the muscular and skeletal system. Day-after-day strain can cause conditions or disabilities following which rehabilitation is necessary.

Rehabilitation is fundamental to all nursing services, but nursing is only one aspect of rehabilitation services. Organized efforts on the part of governments, industries and health services have returned thousands of disabled persons to employment. Much is being done but as yet not all ill or disabled persons in our communities have been taught to live a satisfying, wholesome and useful life within their capacities. Are we as public health nurses doing our best in case-finding, reporting and prevention? Do we know of the ever-increasing local and provincial facilities for rehabilitation?

The newer concept of rehabilitation is still in its infancy. We in nursing today have many opportunities to foster its development.

LETTER FROM GREAT BRITAIN

Dr. Fraser Brockington's next quarterly Letter from Great Britain will appear in the November issue.

The Kitchener Experiment in Industrial Health Services

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HOW to provide industrial medical care for employees in small plants is one of the greatest problems in industrial health today.

Statements of this kind have been made so often as to become commonplace, but it should be remembered that no country has as yet successfully solved this problem.

What constitutes a small plant is a matter of opinion. Rather than fix an arbitrary number of employees, it is probably better to count as a "small" plant for this purpose one which does not warrant the employment of a full-time plant physician. Thus a small plant can be anything from two men working in a shed to a plant with several hundred employees. In Canada between 60 to 70 per cent of employees work in plants with fewer than 500 persons. It is to this group, and a few larger factories, that our main effort should be directed.

In Kitchener a demonstration of the provision of industrial health services for small plants is being carried out by the Division of Industrial Hygiene of the Ontario Department of Health in co-operation with the Kitchener Health Department. This service is provided free, apart from the cost of premises, equipment and supplies, to any suitable plant for an experimental period of two years. After that it is hoped that the various managements will be sufficiently convinced of its value to carry on the service. The cost of the experiment is being met by a federal health grant. This, so far as we know, is the first time that a government has shown interest in industrial health to the extent of helping industry in the initial difficult period of starting a health service, and enabling them to decide, by means of a trial period, whether it is any good.

The purpose of the Kitchener experiment is therefore to introduce to small plants an industrial health service of as high a standard as possible and comparable to the best which can be found in large companies. If, at the end of two years, any firm is not convinced of the value of the service, it will be free to discontinue or modify it as desired.

Approaches were first made to the Kitchener-Waterloo Academy of Medicine and the Chamber of Commerce. Both these bodies expressed themselves as being in favour of the plan and some 41 firms were then circularized. These represented all factories in the City of Kitchener having 50 or more employees but no medical service. Nine firms returned the reply-paid postcards which

had been sent them, requesting further information. During visits to these concerns it became apparent that with the existing plan of locating a health centre in each plant only those which had from 120 to 150 or more employees would be suitable. It had been hoped that smaller units, near each other, could be grouped and share facilities, but not enough firms of this size were interested, and they were too far apart for convenience.

Eighteen firms which were suitable from the standpoint of size were visited at some length. Eight have so far agreed to join the service and seven of these now have health services in operation.

Each plant is provided with a registered nurse, full-time in the case of the larger plants, half-time in those with around 150 employees. These half-time nurses work for 4 hours each morning and the first-aid part of their work is taken over in the afternoon by the first-aid man. Before starting in the plant, all nurses are given an orientation course for one week. A local general practitioner, chosen by management, is associated with each plant and is responsible for preplacement and periodic examinations. It is hoped that later it will be possible for these doctors to undertake more work in the plants so that at the end of two years they will be acting as part-time plant physicians. At present the in-plant medical work other than examinations is done by a physician from the Division of Industrial Hygiene who is living in Kitchener. This work consists of consultations, either referred by the nurse or with patients who themselves ask to see the doctor, plant health surveys, supervision of first-aid arrangements, advising management on health problems and other functions. The program which is offered to plants includes preplacement and periodic medical examinations, first-aid care for injuries and medical emergencies, supervision of employees returning to work after illness or injury, health counselling, health surveys of the plant and industrial hygiene service.

Examinations, both preplacement and periodic, are thorough. They occupy one hour—half an hour with the nurse, during which she acquaints the patient with the functions of the health centre, takes the occupational history and carries out certain procedures; and half an hour for the physician to take the health history and examine the patient. Chest x-rays are taken at the local hospitals.

A system of records has been initiated. Apart from individual health records for each employee, visits to the health centre are recorded by diagnosis groups and a simple method of recording sickness absence is being introduced. Where there is only a half-time nurse, visits to the health centre are recorded by a simplified system which can be continued by the first-aid man in the afternoons.

A standard type of health centre has been designed which is being constructed by those plants, the majority, which have no suitable existing accommodation. This consists of an area approximately 10 feet by 20 feet, divided into an outer room of about 10 feet by 14 feet, which is the nurse's treatment room and office, and an inner room 6 feet by 10 feet or larger for medical examinations. It is thought that this small health centre should be suitable for plants having from 150 to 350 or more employees. The plants provide this accommodation at their own expense and also purchase a minimum amount of

standard equipment; nurses' salaries and doctors' fees are paid by the grant. Standing orders have been written for the nurses. Drugs and dressings to carry out the procedures therein are supplied by the company.

The service is administered jointly by the Ontario Division of Industrial Hygiene and the Kitchener Department of Health. Dr. G. E. Duff Wilson, Medical Officer of Health of Kitchener, was responsible for suggesting the possibility of the project and has continued to do everything possible to make it a success. By his courtesy the administrative office of the project is housed in his department. Thus a valuable link is made between the public health and industrial health services of the city. The writer is responsible for the planning and general administration of the service. The full-time assistant medical officer is Dr. S. J. M. Walker, who is responsible for all the in-plant work apart from examinations. Miss Florence Kudoba, R.N., is industrial nursing consultant and her services are contributed by the Kitchener Department of Health. She administers and advises on the nursing aspects of the service. There is also a committee of the Kitchener-Waterloo Academy of Medicine which can be consulted on medical policy and another composed of local leaders of the nursing profession who advise regarding nursing policy. It is hoped later to form an advisory committee from representatives of the managements of member firms and union representatives.

The effect which an industrial health service has on any given factory is notoriously difficult to measure, but efforts are being made to do this in the case of individual plants in so far as it is practicable. In this respect it resembles the personnel department and, because it is not in the direct line of production, is subject to the same enquiry by management as to whether it is really paying its way by savings effected. Many companies with well-run industrial medical services are convinced that the medical department not only pays for itself but makes possible a considerable saving in production costs and that without it the company would operate less efficiently. These savings are probably effected by a reduction in time lost from work through illness or accident, by ensuring that all new employees are fit physically and mentally for the job they will be expected to do, or if not, are placed in a job which is within their capacities, and by a general improvement in employees' health and morale. These are, today, the only grounds on which we can seriously commend industrial health services to management. The advantages to employees are also many. They appreciate the thorough medical examinations, and also realize, if it is explained to them, that the careful placement which follows ensures that their job is one which will not harm their health in any way. They also receive considerable medical advice, emergency treatment and early diagnosis which they would not otherwise have.

In some instances, however, companies have installed industrial health services which are not complete enough to have any appreciable effect. Particularly is this the case with the amount of time which the doctor spends in the plant. To employ a doctor for a minimal amount of time may be less costly in the first instance, but in the long run an inadequate service will prove to be a waste of money since it will be insufficient to have any real effect on the company's operation. Employers who wish to establish a health service

would find it helpful to obtain expert advice first. They will then get a clear picture of what the duties of the plant physician and nurse should be and of the amount of time each should spend at the plant.

The success of the Kitchener experiment will depend in no small measure on the amount of extra time which the general practitioners concerned can manage to give at the various plants when the federal grant comes to an end, and on the willingness of the firms to pay for this. We are particularly fortunate in having found general practitioners with a good approach to the work and nurses who have, with the help of medical guidance, readily adapted themselves to a job which is new to them.

TWENTY-SECOND ANNUAL CHRISTMAS MEETING

LABORATORY SECTION

Canadian Public Health Association

MONTREAL

DECEMBER 13 and 14, 1954

Headquarters

Institute of Microbiology and Hygiene

University of Montreal

Hospitalization Experience of a Government Hospital Care Insurance Plan

PART 2

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Availability of Hospital Beds

When the Plan commenced operations in 1947 the number of general hospital beds in Saskatchewan was far short of the 7.5 beds per 1,000 persons which was the standard later established as a desirable goal by the provincial Health Survey Committee. The demand for hospital accommodation was greater than could be met with existing facilities, and, as new construction made additional beds available in ensuing years, such beds were soon filled with patients. The total volume of hospital care provided in Saskatchewan has therefore been closely related to the number of available beds. This may readily be seen in Table 10, which reveals a steadily rising number of beds accompanied by a fairly constant ratio of admissions to beds. As the Plan provides coverage of hospital care for most of the provincial population, and as

TABLE 10
Cases per Bed in Saskatchewan Hospitals, 1947–1952

Year	Rated Bed Capacity of Sask. Hospitals*			Total Admissions per Bed	S.H.S.P. Discharged Cases per Bed†
	Beginning of Year	End of Year	Average		
1947	3,966	4,229	4,098	31.9	28.6
1948	4,229	4,692	4,461	32.6	29.6
1949	4,692	5,202	4,947	32.9	29.9
1950	5,202	5,418	5,310	31.6	28.6
1951	5,418	5,577	5,498	29.9	27.3
1952	5,577	5,693‡	5,635‡	30.7‡	27.7‡

*Excludes beds in mental hospitals, tuberculosis sanatoria and Federal government institutions.
†Includes a few cases cared for in D.V.A. and Indian hospitals and non-tuberculous cases in tuberculosis sanatoria, representing less than one quarter of one per cent of the total in each year.
‡Preliminary figure.

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nearly all such care is provided in Saskatchewan institutions, the number of beds has been an important factor in determining the volume of cases for which the Plan accepts financial responsibility.

It will be observed in Table 10 that a slight downward trend in the number of cases per hospital bed is evident in the last three years. This may be attributed in part to the fact that during the past two years, when the Plan's rates of payment have been under negotiation, a considerable number of hospitals have been requested to budget for an average patient occupancy which would decrease or eliminate overcrowding (4). This step has been taken whenever recorded experience has indicated that the number of hospital beds available to an area has become large enough to provide an adequate standard of care. The trend displayed in Table 10 therefore may be taken as one indication of an improvement in the standard of hospital care, through the reduction of overcrowding, as the number of beds approaches the goal outlined in the Health Survey Report.

Municipalities in Saskatchewan vary considerably in the number of hospital cases per 1,000 experienced annually. In 1952 rates in municipalities ranged from less than 150 cases per 1,000 to more than 350 cases per 1,000. This pattern has been fairly constant for a number of years in the sense that areas with relatively high or low hospitalization rates tend to continue to experience such rates. The distribution of the population as between cities, towns, villages and rural areas is known to be one factor in the pattern (5). There may be many others. The data in Table 10 suggest that the supply of hospital beds is one of these factors.

In the majority of hospitals in the province the proportion of cases coming from any given municipality tends to be very nearly the same from year to year. Even in hospitals which experience a rise or fall of 25 per cent or more in volume of cases from one year to the next the percentage distribution of cases according to residence will usually change very little. This fact makes it possible to allocate the measured or rated bed capacity of a hospital among municipalities, according to the residence of patients, for the purpose of comparing the number of beds available to different areas with the number of hospital cases coming from such areas. While this approach ignores certain factors, such as the urban and rural distribution of the population, which are the cause of long-term differences in hospitalization rates (5), it does provide a tool which may throw some light on the relationship between the supply of hospital beds and the volume of hospital care.

In order to present information for this study regarding the distribution of beds in the province, the bed capacity utilized by beneficiaries in each hospital has been apportioned to municipalities according to the residence of patients discharged in 1952. For the few cases treated in tuberculosis sanatoria, Federal government institutions and in general hospitals outside Saskatchewan, an allowance has been included in the apportionment equal to the average bed value per case in the province.

The relationship between the volume of hospital cases and the number of beds which results from this procedure may be seen in Table 11. It will be observed that an increase in the number of cases per 1,000 occurs when there

is an increase in available beds, except in the groups with 5–5.9 beds and 8–8.9 beds per 1,000. These two groups contain a large proportion of city residents, for whom the number of hospital cases per 1,000 is known to be much lower than the provincial average, although their average stay when hospitalized is longer (5).

The same relationship between hospital beds and cases may be seen in the scatter diagram in Figure 1.

As previously noted, in any area with a shortage of hospital facilities one might expect that the number of cases would increase as the supply of beds rose toward an optimum level. The surprising fact revealed in Table 11, and in Figure 1, is that the volume of cases continues to rise even when the supply of hospital beds is well above the level of 7.5 per 1,000 recommended by the Health Survey Committee. Some of the hospitals in the areas possessing more than an adequate supply of beds have actually been overcrowded, with the average patient occupancy at a far higher level than would permit efficient operation or a high standard of patient care. These institutions, as previously noted, have been requested to draw up their annual budgets, on which the Plan's payments are determined, on the basis of a restricted average occupancy

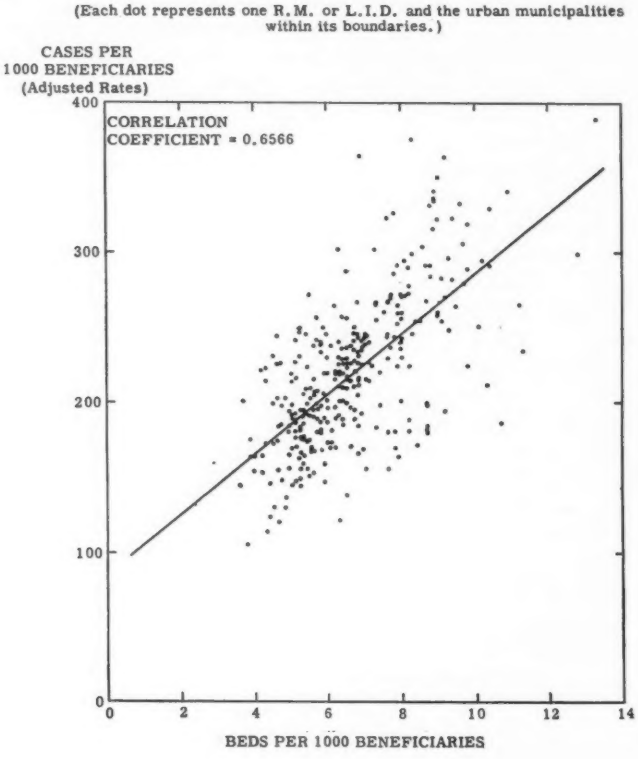

FIG. 1

HOSPITAL CASES IN RELATION TO HOSPITAL BEDS, 1952

which will eliminate overcrowding and thus make possible a better standard of care for patients in the institution. Action of this kind was first taken in 1951, after the introduction of a change in the Plan's system of payment to hospitals. One of the major features of this payment policy was the arrangement of payments in such a way as to eliminate any financial incentive to overcrowd the institutions, in so far as hospital managements are concerned (4).

In discussions with hospital officials one of the principal factors said to influence the level of occupancy has been the demand of doctors for more beds to accommodate their patients. There can be little doubt that there is generally a strong financial incentive for a practising physician to make use of any additional hospital beds which may be placed at his disposal. In the first place, more patients can be attended in hospital in a given time than at home. This is particularly the case in rural areas where the distance factor largely determines higher case rates than the experience in urban communities (5). Secondly, there are decided advantages in caring for certain patients in hospital compared with treating them in the physician's office. In hospital, professional and lay personnel will carry out part of the work which would otherwise have to be done by the doctor or the staff in his office. Adding weight to the economic incentive is the fact that patients will sometimes ask the doctor to arrange hospitalization for procedures which could be performed on an out-patient basis. Such requests may be prompted in many cases by the fact that the Plan does not pay for out-patient services.

It might be expected that the average length of stay would increase with additional hospital beds. However, the mean and median days of stay for each area, as reported in Table 11, provide no conclusive evidence that this is the case.

TABLE 11

VOLUME OF HOSPITAL CARE AMONG S.H.S.P. BENEFICIARIES IN RELATION TO AVAILABLE HOSPITAL BEDS, 1952

Item	Total	Distribution According to Geographic Areas with Specified Number of Hospital Beds per 1,000 Beneficiaries								
		3–3.9	4–4.9	5–5.9*	6–6.9	7–7.9	8–8.9†	9–9.9	10–10.9	11+
Number of R.M. or L.I.D. Areas**	321	5	34	84	85	41	39	22	7	4
Beneficiaries	786,497	6,800	71,144	234,805	187,291	71,364	164,901	34,367	11,560	4,265
Hospital Beds Used by Beneficiaries										
Number	5,217	25	323	1,263	1,202	535	1,379	319	120	51
Per 1,000 Beneficiaries	6.6	3.7	4.5	5.4	6.4	7.5	8.4	9.3	10.4	12.0
Discharged Hospital Cases										
Number	161,499	1,019	12,934	42,402	39,056	16,858	34,776	10,064	3,183	1,207
Rate per 1,000 Beneficiaries										
Crude	205.3	149.9	181.8	180.6	208.5	236.2	210.9	292.8	275.3	283.0
Adjusted‡	205.4	156.3	186.1	180.9	210.4	238.4	207.3	292.6	278.0	279.4
Average Days of Stay										
Mean	10.6	9.5	9.5	10.5	10.3	9.8	11.8	10.9	9.5	11.0
Median	7.0	7.0	6.0	7.0	7.0	6.0	7.0	6.0	6.0	7.0

*Includes City of Saskatoon.
**An area includes a rural municipality or local improvement district and the urban municipalities within its boundaries. The Northern Saskatchewan Administration District and Prince Albert National Park are each treated as one area.
†Includes Cities of Moose Jaw and Regina.
‡Adjusted by the direct method, using 1951 beneficiaries as a standard population.

TABLE 12

PERCENTAGE DISTRIBUTION OF BENEFICIARIES, HOSPITAL BEDS, AND HOSPITAL CASES ACCORDING TO SUPPLY OF HOSPITAL BEDS, 1952

Beds per 1,000 Persons	Percentage Distribution		
	Beneficiaries	Hospital Beds	Discharged Hospital Cases
Total	100.0	100.0	100.0
3–	0.9	0.5	0.6
4–	9.0	6.2	8.0
5–	29.8	24.2	26.3
6–	23.8	23.0	24.2
7–	9.1	10.3	10.4
8–	21.0	26.4	21.5
9–	4.4	6.1	6.2
10–	1.5	2.3	2.0
11+	0.5	1.0	0.8

Note: Provincial average 6.6 beds per 1,000.

It will be noted in Table 12 that in all areas with less than the average number of hospital beds there is a greater percentage of total cases than of total beds, while the reverse is true in areas possessing more than the average quantity of beds per 1,000 persons. Budgets and other reports received from hospitals indicate that this is primarily the result of overcrowded hospitals in areas that possess inadequate facilities. The situation has improved greatly during the past several years with the construction of additional hospital accommodation, and still further improvement may be expected in the near future with the completion of the University Hospital at Saskatoon.

SURGICAL OPERATIONS

The volume of surgical care provided in Saskatchewan hospitals forms a significant part of the benefits received under the Plan. As revealed in Table 9, diagnoses for which surgery is usually performed are among the leading causes for admission. Patients admitted for surgical operations comprise just under one-third of total admissions.

Primary surgical operations performed on hospitalized beneficiaries of the Plan in the three years 1950 to 1952 are summarized in Table 13. Data on operations prior to 1950 are unavailable, as that was the first year in which this type of information was recorded.

When total primary operations are grouped according to geographic areas with varying quantities of hospital beds, as in Table 14, it will be seen that in 1952 such operations ranged from a rate of 42.3 per 1,000 persons in areas with 3–3.9 beds per 1,000 to a maximum of 77.1 in areas with 9–9.9 beds per 1,000. These data reveal a direct relationship between the rates of surgical operations and the supply of hospital beds. The scatter diagram in Figure 2 presents a similar correlation between the hospital–bed ratio and the rate of surgical operations.

TABLE 13

Primary Surgical Operations Performed on S.H.S.P. Beneficiaries, 1950–1952

Operations	Number of Operations			Crude Rate per 1,000 Beneficiaries			Rate per 1,000 Discharged Cases		
	1950	1951	1952	1950	1951	1952	1950	1951	1952
All Operations	48,258	45,759	47,761	62.9‡	58.7‡	60.7‡	309.4	295.5	295.7
Tonsillectomy, Adenoidectomy	12,587	10,042	9,427	16.4	12.9	12.0	80.7	64.9	58.4
Appendectomy	5,678	5,096	5,010	7.4	6.5	6.4	36.4	32.9	31.0
Dilatation and Curettage	2,493	1,537	1,812	6.8*	4.1*	4.8*	16.0	9.9	11.2
Extraction of Teeth	2,119	2,313	2,443	2.8	3.0	3.1	13.6	14.9	15.1
Herniotomy	1,689	1,805	2,026	2.2	2.3	2.6	10.8	11.7	12.5
Cystoscopy	1,428	1,584	1,635	1.9	2.0	2.1	9.1	10.2	10.1
Reduction of Fracture	1,245	1,336	1,480	1.6	1.7	1.9	8.0	8.6	9.2
Cholecystectomy	1,133	1,090	1,184	1.5	1.4	1.5	7.3	7.0	7.3
Blood Transfusions	1,074	1,338	1,566	1.4	1.7	2.0	6.9	8.6	9.7
Suture Wound Injury	992	923	906	1.3	1.2	1.2	6.4	6.0	5.6
Haemorrhoidectomy	850	833	1,012	1.1	1.1	1.3	5.4	5.4	6.3
Incision & Drainage of Abscess, Carbuncle, etc.	840	691	535	1.1	0.9	0.7	5.4	4.5	3.3
Local Excision of Skin Area	804	765	837	1.1	1.0	1.1	5.2	4.9	5.2
Phlebectomy	710	661	822	0.9	0.8	1.0	4.6	4.3	5.1
Hysterectomy	705	733	739	1.9*	2.0*	2.0*	4.5	4.7	4.6
Prostatectomy	643	597	641	1.6†	1.5†	1.6†	4.1	3.9	4.0
Circumcision	584	490	503	1.5†	1.2†	1.2†	3.7	3.2	3.1
Laparotomy	506	602	619	0.7	0.8	0.8	3.2	3.9	3.8
Cystocele & Rectocele	361	470	292	0.5*	0.6*	0.4*	2.3	3.0	1.8
Amputation (Extremities)	359	371	336	0.5	0.5	0.4	2.3	2.4	2.1
Thyroidectomy	358	402	486	0.5	0.5	0.6	2.3	2.6	3.0
Hysteropexy	312	287	477	0.8*	0.8*	1.3*	2.0	1.9	3.0
Caesarean Section	304	330	282	0.8*	0.9*	0.7*	1.9	2.1	1.8
Biopsy of Breast	297	441	409	0.4	0.6	0.5	1.9	2.9	2.5
Oophorectomy	283	376	362	0.8*	1.0*	1.0*	1.8	2.4	2.2
Lumbar Puncture	259	221	444	0.3	0.3	0.6	1.7	1.4	2.7
Proctoscopy & Sigmoidoscopy	205	268	355	0.3	0.3	0.5	1.3	1.7	2.2
Encephalography	197	299	334	0.3	0.4	0.4	1.3	1.9	2.1
Cauterization of Cervix	172	211	223	0.5*	0.6*	0.6*	1.1	1.4	1.4
All Others	9,071	9,647	10,564	11.8	12.4	13.4	58.2	62.3	65.4

*Rates based on female beneficiaries.
†Rates based on male beneficiaries.
‡Details do not add to total because certain rates are based on male or female beneficiaries.

TABLE 14

Volume of Primary Surgical Operations in Relation to Available Hospital Beds, 1952

Available Hospital Beds per 1,000 Beneficiaries	Number of R.M. or L.I.D. Areas	Primary Surgical Operations		
		Number	Rate per 1,000 Beneficiaries	
			Crude	Adjusted
Total	321	47,761	60.7	60.7
3−	5	282	41.5	42.3
4−	34	3,678	51.7	52.1
5−	84	13.043	55.5	55.6
6−	85	10,673	57.0	57.1
7−	41	4,583	64.2	64.3
8−	39	11,727	71.1	70.6
9−	22	2,662	77.5	77.1
10−	7	788	68.2	68.1
11+	4	325	76.2	74.9

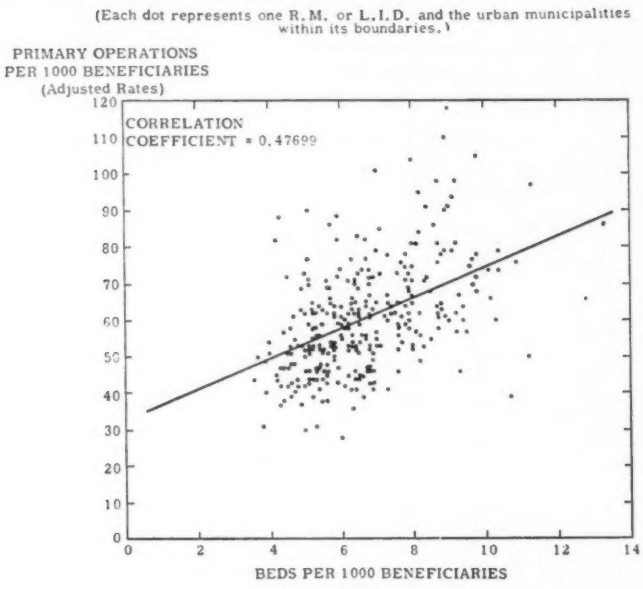

FIG. 2

SURGICAL OPERATIONS IN RELATION TO HOSPITAL BEDS, 1952

The differential between municipalities is proportionately much greater for certain operations, of course, than for the total of primary operations. The appendectomy rate in 1952, for example, ranged from less than four in some municipalities to more than 11 per 1,000 in other communities. The tonsillectomy and adenoidectomy rate also displayed a proportionately greater differential, ranging from less than three operations per 1,000 in some areas to more than 24 per 1,000 in others.

While elective surgical operations in any area might be expected to increase as the number of beds rises to an adequate level, there is no apparent reason why the trend should continue upward when the supply of beds becomes more than adequate, other than the fact that the doctor is provided with facilities for admitting additional surgical cases. When similar statistics become available in other provinces it will be interesting to see whether the same relationship will be found between the supply of beds and the volume of surgical operations. If the same trend is widespread, medical and hospital organizations should make a critical review of this situation before public opinion demands that such be done.

EFFECT OF MEDICAL AND SURGICAL COVERAGE

Close to 30 per cent of the residents of Saskatchewan are located in areas where coverage of medical care, or both medical and surgical care, is provided on a community-wide basis. Arrangements for medical and surgical care have

been made (a) through a large number of contracts between municipalities and practising physicians, (b) through the operation of the regional program in the Swift Current Health Region, and (c) through numerous contracts between municipalities and private insurance organizations. A percentage

TABLE 15

PERCENTAGE DISTRIBUTION OF BENEFICIARIES ACCORDING TO AVAILABILITY OF MEDICAL OR SURGICAL CARE INSURANCE AND SUPPLY OF HOSPITAL BEDS, 1952

Hospital Beds per 1,000 Beneficiaries	All Areas	Without Municipal or Regional Coverage of Medical or Surgical Care*		With Municipal or Regional Coverage of Medical or Surgical Care	
		Cities	Towns Villages and Rural	Cities	Towns Villages and Rural
Total	100.0	23.6	46.6	0.9	28.9
3−	0.9	—	0.4	—	0.5
4−	9.0	—	7.1	—	1.9
5−	29.8	7.4	12.8	—	9.6
6−	23.8	3.1	12.6	0.9	7.2
7−	9.1	—	6.0	—	3.1
8−	21.0	13.1	3.6	—	4.3
9−	4.4	—	3.1	—	1.3
10−	1.5	—	0.8	—	0.7
11+	0.5	—	0.2	—	0.3

*An unknown proportion of the population in these areas is provided with medical or surgical coverage through individual or group insurance contracts with private organizations. A small percentage of the population in these areas also receives medical and surgical coverage under social assistance programs.

distribution of the Plan's beneficiaries in 1952 according to the availability of coverage of this kind appears in Table 15. Private insurance organizations, in addition to their contracts with municipalities, also provide coverage of medical and surgical care through individual and group contracts, most of which is believed to be concentrated in the larger urban centres of the province.

A comparison of the number of hospital cases per 1,000 in areas having community-wide coverage of medical or surgical care with the rates of other areas, which is presented in Table 16, reveals no striking differences in the incidence of hospitalization which could be attributed to the existence of such coverage. (Crude rates only are presented in Table 16, as it is evident from previous tabulations that they do not differ widely from age-sex-adjusted rates.)

A similar comment may be made regarding the incidence of surgical operations. Surgical operation rates in areas with municipal or regional coverage of medical or surgical care are compared in Table 17 with rates of areas lacking such coverage. When surgical rates in cities and other areas lacking coverage are compared with areas covered by prepayment plans in the same bed ratio groups, no consistent differences are revealed. However, the step-by-step rise in the bed ratios is accompanied by similar increases in surgical rates, except in areas with 10 or more beds per 1,000, which contain only two per cent of the

TABLE 16

HOSPITAL CASES PER 1,000 BENEFICIARIES* ACCORDING TO AVAILABILITY OF MEDICAL OR SURGICAL CARE INSURANCE AND SUPPLY OF HOSPITAL BEDS, 1952

Hospital Beds per 1,000 Beneficiaries	All Areas	Without Municipal or Regional Coverage of Medical or Surgical Care		With Municipal or Regional Coverage of Medical or Surgical Care	
		Cities	Towns Villages and Rural	Cities	Towns Villages and Rural
All Areas	205.3	172.4	213.9	174.0	219.4
3–	149.9	—	149.6	—	150.0
4–	181.8	—	178.9	—	192.9
5–	180.6	148.9	189.8	—	192.6
6–	208.5	188.0	211.3	174.0	217.1
7–	236.2	—	238.4	—	231.9
8–	210.9	181.9	260.0	—	257.9
9–	292.8	—	291.9	—	295.1
10–	275.3	—	281.9	—	267.3
11+	283.0	—	274.3	—	286.6

*Crude Rates.

TABLE 17

PRIMARY SURGICAL OPERATIONS PER 1,000 BENEFICIARIES* ACCORDING TO AVAILABILITY OF MEDICAL OR SURGICAL CARE INSURANCE AND SUPPLY OF HOSPITAL BEDS, 1952

Hospital Beds per 1,000 Beneficiaries	All Areas	Without Municipal or Regional Coverage of Medical or Surgical Care		With Municipal or Regional Coverage of Medical or Surgical Care	
		Cities	Towns Villages and Rural	Cities	Towns Villages and Rural
All Areas	60.7	64.2	58.1	57.5	62.1
3–	41.5	—	45.4	—	37.8
4–	51.7	—	51.7	—	51.5
5–	55.5	54.4	54.8	—	57.5
6–	57.0	58.1	55.1	57.5	59.7
7–	64.2	—	63.1	—	66.4
8–	71.1	71.3	69.1	—	72.4
9–	77.5	—	76.8	—	78.9
10–	68.2	—	66.1	—	70.7
11+	76.2	—	51.5	—	86.4

*Crude Rates.

population. The availability of beds, therefore, would appear to be one of the principal factors associated with the volume of surgical operations.

SUMMARY AND CONCLUSIONS

In the six years 1947 to 1952 the Saskatchewan Hospital Services Plan has accepted responsibility for accounts covering more than 90 per cent of in-patient hospital care received by residents of the province. The annual volume of cases among the Plan's beneficiaries has grown roughly in proportion to the total supply of hospital beds in Saskatchewan. Some further expansion of the

number of cases per 1,000 beneficiaries may be expected as the supply of hospital beds approaches the goal of 7.5 beds per 1,000 recommended by the provincial Health Survey Committee.

The total volume of care is analyzed by age, sex and diagnosis. Very few data concerning hospital care outside Saskatchewan are available to make detailed comparisons.

This study of morbidity experience among hospital in-patients does not provide any clear-cut indication of the existence of a backlog of elective cases at the inception of the Plan or of the elimination of such a backlog.

There is considerable variation between municipal areas at the present time in the number of hospital beds per 1,000 persons. This seems to be one of the principal factors accounting for differences between areas in the incidence of hospitalization. Areas with very few beds in relation to population experience a higher level of occupancy in their hospitals than is desirable for the maintenance of the best standard of patient care, a situation which is improving rapidly as new hospital facilities become available. Undoubtedly, other factors affecting the volume of hospital care will become evident in future studies.

A correlation has been observed between the number of hospital beds and the incidence of surgical operations. The trend has been for areas with more than the average number of hospital beds per 1,000 persons to experience higher than average operation rates, while areas with relatively few beds have less than the average number of surgical operations.

Areas of the province in which coverage of medical or surgical accounts is provided on a municipal or regional basis do not experience markedly different hospitalization or surgical rates than other areas with similar bed ratios lacking such coverage.

The following conclusions may be drawn from the Plan's hospitalization experience respecting the development of any hospital or medical care insurance program covering an entire province or region:

1. The volume of hospital care which must be financed by the program is likely to be determined to a large degree by the bed complement of the province or region, at least until the number of hospital beds is considerably greater than the quantity presently available in most parts of this country.

2. Close control of hospital construction in accordance with an approved and accepted survey of the hospital needs of the area is essential because of its ultimate effect on the cost of the insurance program.

3. Coverage of medical and surgical care may not cause a marked increase in the number of hospital cases.

4. A close relationship between the volume of surgical operations and the number of available hospital beds can be expected in circumstances similar to those of Saskatchewan.

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A Comparison Between Disk-Plate and Tube-Dilution Methods for Antibiotic Sensitivity Testing of Bacteria

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THE need for antibiotic sensitivity testing of bacterial species in a hospital laboratory cannot be questioned. Although some species retain a fairly constant degree of sensitivity to the various antibiotics, others vary widely and may be constantly changing with the increasing use of the drugs. The introduction of new antibiotic agents increases the need for sensitivity tests.

Many methods of sensitivity testing have been devised. All have received criticism, for all may shown variability, particularly if insufficient attention is given to careful standardization of technique. Two methods in common use are the tube-dilution and the disk-plate.

The tube-dilution method is derived from the Rammelkamp (1) method for penicillin assay, and appears to be one of the most reliable. Jackson and Finland (2) were able to duplicate results by this method within a two-fold error. In 65 duplicate estimations Weisben et al. (3) obtained results within a two-fold dilution in 61 and within four-fold in four.

There are obvious disadvantages to the tube-dilution method. Some organisms do not grow well in fluid media, contamination is not easily seen, errors can arise in the preparation and storing of standards and in the making of dilutions. The test is time-consuming to perform, and this may create difficulties in testing the large numbers of strains to the many antibiotics that may be requested in clinical laboratory practice.

Disk-plate sensitivity methods have arisen from Heatley's cylinder technique for penicillin assay. Vincent and Vincent (4) and many other workers substituted filter paper disks for cylinders, and this was modified by Bondi (5) to a sensitivity testing method using saturated disks. Similar techniques have been used by several other workers (6–10). Obvious disadvantages of these methods are the technical difficulties in preparing standard solutions and in handling the disks. An important modification was the introduction of commercially prepared dry disks. Their use greatly simplifies the problems of sensitivity testing, as the method becomes easily standardized, the techniques are simple, and there is no delay in obtaining results. The method is not so time-consuming as to discourage the sensitivity testing of any organism.

Assisted with funds allocated by the Province of Ontario under the National Health Grants program of the Department of National Health and Welfare, Ottawa.

Patrick (11) and Brande (12) found limited correlation between a tube-dilution method and tests with one commercial make of sensitivity disk. Hoyt and Goolden (13) carried out a survey of several brands of disks, finding them sufficiently accurate to distinguish between sensitive and resistant organisms. Bacto Sensitivity Disks (Difco) have been reported as possessing various degrees of accuracy in the hands of a number of workers (14–20).

This study was undertaken to establish the reliability of the disk-plate method as compared with a standardized tube-dilution technique.

Materials

Strains

Twenty-five or more strains of each of the following species were employed: *Diplococcus pneumoniae*, *Streptococcus pyogenes* (Lancefield Group A), *Staphylococcus pyogenes*, *Hemophilus influenzae* (type b), *Shigella sonnei*, *Pseudomonas aeruginosa*, and *Escherichia coli*. All strains were freshly isolated from patients, in most instances before the institution of antibiotic therapy. They were maintained on 5% sheep's blood agar and kept refrigerated, except for *Hemophilus influenzae*, which was subcultured daily to Levinthal agar. Sensitivity tests were done as promptly as possible, to obviate unnecessary subculturing and possible alterations in sensitivities.

Antibiotics

Bacto Sensitivity Disks (Difco) were used throughout. Disks of three concentrations of each of eight antibiotics were available as follows:

Penicillin	—0.5, 1.0, 10 units	Oxytetracycline	—10, 30, 60 mcg.
Dihydrostreptomycin	— 1, 10, 100 mcg.	Bacitracin	— 2, 10, 20 units
Chlortetracycline	—10, 30, 60 mcg.	Polymyxin B	— 5, 10, 30 mcg.
Chloramphenicol	—10, 30, 60 mcg.	Erythromycin	—0.5, 1, 10 mcg.

Stock solutions of the 8 antibiotic standards* were prepared as 1,000 units or mcg. per ml. in Penassay broth (Difco), and kept frozen for periods up to eight weeks. A fresh vial of chlortetracycline was opened for each day's testing. Usually a new vial of each of the other antibiotics was opened for each series of tests, but occasionally stock solutions were kept refrigerated for three or four days before use. Drugs were checked for loss of potency after eight weeks in the frozen state. There was no evidence of deterioration.

Methods

Each strain was tested simultaneously by both the disk-plate and tube-dilution methods.

Strains of *Staphylococcus pyogenes*, *Sh. sonnei*, *Ps. aeruginosa* and *E. coli* were grown in Penassay broth for 18 hours at 37°C. Pneumococci and streptococci were cultured in Penassay broth with 10% sterile horse serum added, and Levinthal broth was employed for *H. influenzae*.

Disk-Plate

One ml. of the 18-hour culture was flooded over each of four blood agar plates (or Levinthal). The excess was pipetted off, the plates allowed to dry for

10 minutes, and six disks (three concentrations of each of two antibiotics) were placed at equidistant points on each plate with alcohol-flamed forceps. The plates were incubated at 37°C. for 18 hours.

Tube-Dilution

Each culture was adjusted to 100 units on the Klett-Summerson photoelectric colorimeter equipped with a red filter, then diluted 10^{-4} in the same medium. Final dilutions of pneumococci and streptococci were made in Penassay broth containing 20% horse serum. These served as the inocula.

For all organisms except *H. influenzae* (for which the drugs were diluted in Levinthal broth) the stock solutions of antibiotics were diluted to 200 mcg./ml. in Penassay broth, or further diluted for very sensitive organisms. Serial doubling dilutions were made from these in a series of ten tubes and 0.5 ml. aliquots of each concentration were pipetted into a suitable number of Wassermann tubes. Usually four strains were tested at one time. An eleventh tube containing 0.5 ml. broth served as an antibiotic-free control. The inocula were added in 0.5 ml. volume to each tube. The tubes were incubated at 37°C. for 18 hours.

Interpretation of Tests

The disk method, in our opinion, does not allow exact quantitative readings to be made. The diameter of the zones of inhibition varies with the antibiotic and to some extent with the test organism. These variations do not permit too much importance to be attached to zone size. The three-disk technique, however, permits an overall picture to be obtained, facilitating the interpretation of zones of inhibition. The zones of inhibition were measured with the aid of calipers, simply as an aid in recording results, and as a help in distinguishing between degrees of sensitivity for correlation with the tube-dilution results.

The results of the disk tests were categorized into five degrees of sensitivity as follows:

Very Sensitive: Large zone of inhibition (greater than 9–10 mm., including the diameter of the disk) around the disk of lowest concentration and large zones around the disks of intermediate and greatest concentration.

Sensitive: Small zone around the disk of lowest concentration, and moderately large zones around the other two.

Moderately Sensitive: No zone around the disk of lowest concentration, but zones around the other two.

Slightly Sensitive: A zone only around the disk of greatest concentration.

Resistant: No zones around any disk.

An attempt was made to follow exactly the same definitions within each antibiotic series. The fact that a series of tests rather than a single one was being examined simultaneously made interpretation easier.

Occasionally during incubation some overgrowth of the test organism occurred over the initial zone formed. When this was the case, but the zone outlines were still quite clear, the readings were interpreted as one category less sensitive than the original zones would indicate. This happened for the

most part with chlortetracycline and dihydrostreptomycin. Occasionally, overgrowth was so extensive as to make interpretation of the zones impossible.

For purposes of comparison, the end points obtained by the tube-dilution method were translated into categories similar to those established for the disk method. The end point chosen was the lowest concentration of drug showing no visible turbidity at 18 hours. The ranges of concentration selected for these categories of sensitivity were of necessity somewhat arbitrary but were based on data recorded by a large number of investigators. These ranges are shown in the charts.

To define sensitivity into such narrow categories may be without foundation, but for purposes of comparison it enables the measurement of consistency of correlation and the extent and direction of variation. Correlation between the two methods was sometimes exact. It was classified as good, however, when the results were within one category of sensitivity of each other. When the results were two categories apart, there was some correlation, but when they were three categories one from the other, or when the disk was not interpretable, there was no correlation.

Results

Chloramphenicol (Table 1)

Correlation was good with 185 of the 187 strains tested (98.4%). There was some correlation with the other 2. In strains which were either very sensitive or resistant, by tube-dilution, correlation was nearly always exact: 103 of 105, 15 of 16, respectively. There was a tendency for the disks to be interpreted as slightly more sensitive than the tubes, particularly with the sensitive strains.

Polymyxin B (Table 2)

Correlation between the two methods was good with 169 of the 173 strains (97.7%). The exact correlation usually seen with very sensitive and resistant strains was not so marked as with some of the other drugs. Adjustment of our classification at both extremes would have improved the situation. There was some correlation with 3 strains, none with 1.

TABLE 1.

Chloramphenicol

Tube Dilution Interpretation	No. of Strains	Disk Interpretation–No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl. Sens.	Res.	Not Interp.
Very Sens. –5 mcg./ml.	105	103	2				
Sens. 5–15	54	43	11				
Mod. Sens. 15–25	0						
Sl. Sens. 25–50	12		2	2	8		
Res. 50–	16				1	15	

Total.....187
Good Correlation....185 (98.4 %)
Some Correlation.... 2

TABLE 2.

Polymyxin B

Tube Dilution Interpretation	No. of Strains	Disk Interpretation–No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl. Sens	Res.	Not Interp.
Very Sens. –1 mcg./ml.	48	24	22	2			
Sens. 1–2.5	40	9	29	2			
Mod. Sens. 2.5–5	6		5	1			
Sl. Sens. 5–10	1		1				
Res. 10–	78		1		22	55	

Total.....173
Good Correlation....169 (97.7%)
Some Correlation.... 3
No Correlation..... 1

TABLE 3.

Bacitracin

Tube Dilution Interpretation	No. of Strains	Disk Interpretation-No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl. Sens.	Res.	Not Interp.
Very Sens. -0.5 u/ml.	49	39	8	1			1
Sens. 0.5-1	6		6				
Mod. Sens. 1-2.5	7		6	1			
Sl. Sens. 2.5-5	2		1	1			
Res. 5-	101			1	9	91	

Total.....165
Good Correlation...161(97.5%)
Some Correlation... 3
No Correlation..... 1

TABLE 4.

Erythromycin

Tube Dilution Interpretation	No of Strains	Disk Interpretation - No. of Strains					
		Very Sens	Sens	Mod. Sens.	Sl. Sens.	Res.	Not Interp.
Very Sens. -1 mcg./ml.	53	42	7	4			
Sens 1-2	1			1			
Mod. Sens —							
Sl. Sens. -5							
Res. 5-	64					64	

Total.... ...118
Good Correlation...114 (96.6%)
Some Correlation.. 4

Bacitracin (Table 3)

One hundred and sixty-one of 165 strains (97.5%) showed good correlation. One hundred and fifty strains were either very sensitive or resistant and 130 of these correlated exactly. All the other strains except 4 fell within one category; in 1 of these the disk test was not interpretable. One of the disks in this case may have been defective.

Erythromycin (Table 4)

Good correlation was seen with 114 of the 118 strains (96.6%). All but 1 were either very sensitive or resistant by tube-dilution. A few strains failed to agree exactly and were more resistant by tube-dilution. The 4 tests which gave only some correlation were with strains of *H. influenzae.*

TABLE 5.

Oxytetracycline

Tube Dilution Interpretation	No. of Strains	Disk Interpretation-No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl Sens.	Res.	Not Interp.
Very Sens -1 mcg./ml.	99	98	1				
Sens 1-5	53	26	19	3	2	3	
Mod. Sens. 5-10	21	2	1	4	11	3	
Sl. Sens. 10-20	4				1	3	
Res. 20-	10				1	9	

Total..... .187
Good Correlation....177(94 7%)
Some Correlation.. 7
No Correlation... 3

TABLE 6.

Penicillin

Tube Dilution Interpretation	No. of Strains	Disk Interpretation-No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl. Sens.	Res	Not Interp.
Very Sens -0.1 u/ml.	60	59[x]		1[xxx]			
Sens. 0.1-0.5	17	2		6	5[xx] 2[xxx]	2[xxx]	
Mod. Sens 0.5-1	12	2	1	3	5[xx]	1[xxx]	
Sl. Sens 1-10	9			2		7	
Res. 10-	83				4	79	

Total.....181
Good Correlation. .168(92.8%)
Some Correlation... 11
No Correlation. ... 2
x .One disk defective, but still interpretable...15
xx....Interpretation of H. Influenzae difficult...10
xxx. Staphylococcus -possible production of penicillinase...6

TABLE 7.

Chlortetracycline

Tube Dilution Interpretation	No. of Strains	Disk Interpretation – No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl Sens.	Res	Not Interp.
Very Sens. -1 mcg./ml.	105	100	4				1
Sens 1-5	33	6	15				12
Mod. Sens 5-10	17	2	8		2	4	1
Sl. Sens 10-20	18		3		4	10	1
Res 20-	12				3	8	1

Total . 185
Good Correlation. . 160 (85.4 %)
Some Correlation 9
No Correlation. 16

TABLE 8

Dihydrostreptomycin

Tube Dilution Interpretation	No. of Strains	Disk Interpretation – No. of Strains					
		Very Sens.	Sens.	Mod. Sens.	Sl Sens.	Res.	Not Interp.
Very Sens. -1 mcg./ml.	11	1	4	5	1		
Sens. 1-5	66	9	10	27	20		
Mod. Sens. 5-10	31	5	11	7	6		2
Sl. Sens 10-20	35	5	11	11	3		5
Res 20-	38		2	2	10	24	

Total 181
Good Correlation 123 (68 %)
Some Correlation 43
No Correlation 15

Oxytetracycline (Table 5)

Correlation was good with 177 of 187 strains (94.7%); there was some correlation in 7 but none in 3. Of the 109 strains which were either very sensitive or resistant, correlation was nearly always exact, while inaccuracies occurred with the strains of intermediate sensitivity. Strains sensitive by our tube-dilution criteria were in general more sensitive by the disk method.

Penicillin (Table 6)

Of 181 strains tested, correlation was good in 168 (92.8%); there was some correlation in 11, none in 2. Sixty strains were very sensitive and 83 resistant; correlation was good in all but one of these. This strain was *Staphylococcus pyogenes*, and all the strains of intermediate sensitivity in which discrepancies occurred were either *Staphylococcus pyogenes* (6 strains) or *H. influenzae* (6 strains). Part of the error may lie in the behaviour of these two species. In fifteen instances defective disks were noted, but with the use of the three-disk-technique, interpretation was possible.

Chlortetracycline (Table 7)

Correlation was good in 160 of 185 strains (85.4%). There was some correlation in 9, but none in 16 as the zones were overgrown by the test organism to such an extent as to make interpretation impossible.

Dihydrostreptomycin (Table 8)

The results were poorest with dihydrostreptomycin. Good correlation occurred with 123 of 181 strains (68%). In 43 instances there was some correlation, but there was none in 15. With the 77 strains which were very sensitive or sensitive, the tube test tended to indicate a greater degree of sensitivity than the disks, whereas with the less sensitive strains, the discrepancies tended to be in the other direction. This may relate to our classification of sensitivity or to the fact that the zones formed by dihydrostreptomycin were small. Many

of the strains tested were of intermediate sensitivity. Of the 15 strains which lacked correlation, the disks were not interpretable in 7. This was due to overgrowth of the test organism.

Overall Results (Table 9)

A total of 1,377 duplicate tests was done. The results obtained by the two methods fell into exactly the same category 933 times (67.8%) and a further 324 (23.5%) were within the next category, giving an incidence of good correlation of 91.3%. There was some correlation in 82 (5.9%) and none in 38 (2.8%).

TABLE 9.

Correlation between Difco Disk and Tube Dilution Sensitivity Tests

Tube Dilution Interpretation	Good Correlation			"Some" Correlation	No Correlation	Total Tests
	Exact	One Category Different	Total "Good"			
Very Sensitive	466 (87.9%)	48 (9.1%)	514 (97%)	13 (2.4%)	3 (0.6%)	530
Sensitive	90 (33.3%)	134 (49.6%)	224 (83%)	29 (10.7%)	17 (6.3%)	270
Moderately and Sl. Sensitive	32 (18.3%)	92 (52.6%)	124 (70.9%)	37 (21.1%)	14 (8%)	175
Resistant	345 (85.8%)	50 (12.5%)	395 (98.3%)	3 (0.7%)	4 (1%)	402
TOTAL	933 (67.8%)	324 (23.5%)	1257 (91.3%)	82 (5.9%)	38 (2.8%)	1377

The greatest incidence of good correlation was with strains which were either very sensitive or resistant by the tube-dilution method.

By tube-dilution, 530 strains were very sensitive. Exact correlation was found in 87.9% and good correlation in 97%. Some correlation was seen in 13 (2.4%), and only 3 strains (0.6%) failed to show any correlation.

The picture was similar with the 402 resistant strains. Exact correlation occurred in 85.8% and good correlation in 98.3%. There was some correlation in 3 and no correlation in 4 (1%).

Among the strains of intermediate sensitivity, the sensitive strains showed a much poorer incidence of exact correlation than the very sensitive or resistant strains. Only 33.3% of the 270 were exact. Our classification may have been at fault. Correlation, however, was good in 83%.

The 175 strains which were moderately or slightly sensitive gave the poorest results. Only 18.3% showed exact correlation and 70.9% good correlation. Some correlation occurred in 37 and none in 14 (8%).

Of 1,377 tests, 120 failed to show good correlation, 82 giving some and 38 none. The reasons for these discrepancies were not always apparent, but there were some trends which seemed important.

Most of the discrepancies occurred with dihydrostreptomycin, these being seen in 58 tests. In 7 instances, the initial zones around the disks were overgrown. In 26 tests the micro-organisms appeared less sensitive by disk than by tube, and the reverse was seen in 25. The zones of inhibition formed were

consistently small, making differentiation of degrees of sensitivity difficult. The ease of emergence of dihydrostreptomycin-resistant variants on the plates or in the tubes may also have been responsible.

Twenty-five discrepancies occurred with chlortetracycline. In 16 instances this was due to zone overgrowth, making interpretation impossible. This may be related to the instability of this antibiotic.

The production of penicillinase by staphylococci may have created difficulties in 6 instances and was probably responsible for the discrepancy in 1 other test. Penicillin sensitivity tests with such staphylococci are difficult by any technique.

Discrepancies occurred 15 times with *H. influenzae*; 6 of these were with penicillin, 5 with dihydrostreptomycin (included above), and 4 with erythromycin. Tests with this micro-organism were noted on several occasions to be difficult to read and interpret. This was particularly evident with penicillin where, in 10 of the 25 tests done, very large zones were formed around the disk of greatest concentration but none was visible around the other two disks. These were read as slightly sensitive, but only 5 of the 10 agreed satisfactorily with the tube-dilution results. The peculiar cultural characteristics of this micro-organism may have been responsible for these difficulties.

The remaining 20 discrepancies were more difficult to evaluate. They were distributed among the remaining antibiotics as follows: Oxytetracyline—10, Polymyxin B—4, Bacitracin—4, Chloramphenicol—2. They seemed unrelated to the micro-organisms; *Ps. aeruginosa*—7, *E. coli*—6, *Staph. pyogenes*—4, *Sh. sonnei*—2, *Pneumococcus*—1. In 8 tests the micro-organisms appeared more sensitive by disk, and in 12 they were less sensitive. Only 5 were complete correlation failures, 15 showing some correlation. Four occurred among the very sensitive strains, 2 among the resistant strains, and 14 in the intermediates. The fact that almost all were among the intermediates and that almost all showed some correlation may indicate the futility of attempting the differentiation of such strains into three relatively narrow categories of sensitivity by the use of a test as roughly quantitative as the disk-plate technique.

Discussion

The use of quantitative measurements of bacterial sensitivities to help in determining and in assessing antibiotic therapy is highly desirable in clinical practice. The value of the tube-dilution test for this purpose has been established, but, as noted earlier, this method has many disadvantages in a clinical laboratory. Attempts to utilize the simpler disk techniques for quantitative purposes have met with varying degrees of success. The single-disk technique is more qualitative than quantitative, and it is unlikely that the measurement of the size of the inhibitory zone around a single disk can give much quantitative information unless the experimental conditions are most carefully controlled. The use of multiple-disk methods offers greater hope for a degree of quantitation acceptable for clinical needs. The use of more than one disk provides a controlling factor within each test which tends to eliminate errors due to defective disks. The introduction of commercially prepared disks obviates most of the disadvantages for a clinical laboratory. Disk methods, nevertheless, are criticized severely by many.

The studies reported herein indicate that the three-disk technique constitutes a good rough quantitative test. Good agreement between the two methods was found in 91.3% of tests, and gross error in only 2.8%. The disk method fails to allow readings of the Minimal Inhibitory Concentrations in exact micrograms as does the tube-dilution test, but it allows the micro-organisms to be placed into categories of sensitivity. In view of the recognized difficulties in correlating exactly *in vitro* and *in vivo* results, one doubts if further narrowing of these categories would serve any useful purpose. The categories used corresponded to those which have been determined by tube-dilution methods and reported generally as useful.

Some sensitive strains, particularly with chloramphenicol and oxytetracycline, tended to appear more sensitive by disk than by tube. With others the reverse trend was seen. It is unlikely that revision of our classification based on tube-dilution readings or adjustment of the antibiotic content of the disks would have improved the situation very significantly. It is more likely that the disk test lacks exactness, and therefore does not allow grading into narrow categories in all instances. It may, nevertheless, yield valuable information for clinical purposes.

Both tests are subject to errors. Jackson and Finland (2) noted discrepancies ranging up to 128-fold in the results obtained by different methods for any one drug-organism combination. We have seen differences ranging up to 512-fold by the tube test alone, depending on the conditions of the test, time of incubation, choice of end point, etc. The phenomenon of "skipping tubes" often confuses the readings. This "skipping" whereby the first tube showing growth is followed by one or more with no growth occurred in several combinations in this series but seemed more frequent with Polymyxin B when tested against *Sh. sonnei*, *Ps. aeruginosa*, and *E. coli*. Four-fold to eight-fold differences in the two end points were possible, depending on one's interpretation of the possible end points.

There is almost as great need for careful standardization of technique with the disk method as with the tube-dilution test. The factors of size of inoculum, age of the culture used for inoculation, type of medium, dryness of surface, and close apposition of disk to surface of medium are among the important considerations. The simpler disk test, however, would appear to be better suited to the usual clinical laboratory. It is unlikely that a clinical laboratory incapable of controlling adequately the disk technique would be successful in the use of the tube-dilution method.

There is a need for laboratories to adopt a standard method for recording the results as well as a standard method for performing the test so that the results from different laboratories can be compared. We favour classification into the four categories of "sensitive", "moderately sensitive", "slightly sensitive", and "resistant". Such terms as these should be understood readily by all, including the physician, and should not mislead once a local definition of the terms has been established.

SUMMARY

1. A comparison of a three-disk plate and a tube-dilution method of sensitivity testing was made. Tests were done simultaneously by both methods with at least twenty-five strains of seven different bacterial pathogens against eight antibiotics. The results by both tests were categorized into five degrees of sensitivity for purposes of comparison.

2. Of the 1,377 duplicate tests, good correlation between the two methods was found in 1,257 (91.3%), some correlation in 5.9%, and no correlation in 2.8%.
3. The best correlation occurred with strains which by tube-dilution were either very sensitive or resistant.
4. Good correlation was seen in 98.4% of tests with Chloramphenicol, 97.7% with Polymyxin B, 97.5% with Bacitracin, 96.6% with Erythromycin, 94.7% with Oxytetracycline, 92.8% with Penicillin, 85.4% with Chlortetracycline, and 68% with Dihydrostreptomycin.
5. Based on these results, the three-disk plate method constitutes a good rough quantitative test for bacterial sensitivity.
6. The discrepancies between the tests are discussed.

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POLIOMYELITIS VIRUS VACCINES

IN 1949 Enders, Weller and Robbins established that poliomyelitis viruses could be grown in human and monkey tissues. Prior to the discovery that these viruses would grow in non-nervous tissues, the isolation and identification of poliomyelitis viruses involved the inoculation of live monkeys.

In 1952 Salk and his colleagues described a method of preparing experimental poliomyelitis vaccines employing formaldehyde for the purpose of destroying the infectivity of the viruses. In the spring of 1953, Salk immunised a group of children and obtained a satisfactory antigenic response, confirming his earlier findings in monkeys. The details of the preparations and safety testing were outlined in the American Journal of Public Health in May 1954.

In order to determine the protective value of this vaccine, the National Foundation for Infantile Paralysis Inc., New York, on the advice of a committee of experts under the chairmanship of Doctor Thomas Rivers, made plans for a nation-wide trial during the spring months of 1954. It was not possible to prepare the vaccine in the large quantities required in time to commence the program before the end of March. The total number of children in the trial was 650,000, which included more than 200,000 controls who received a harmless placebo.

To evaluate the vaccine, a committee under the chairmanship of Doctor Thomas Francis Jr. of the School of Hygiene, University of Michigan, was appointed by the National Foundation. This committee arranged for the collection, at specific intervals, of blood samples from each child, to determine the antigenic response. Arrangements were made also for the study of all cases of poliomyelitis or suspected infection occurring in the experimental group. Twenty-seven laboratories are co-operating in the testing of the blood samples and in the examination of stool specimens from these patients. A report on the evaluation of the vaccine will be made available as early as possible in 1955.

Of first importance, the administration of the vaccine to more than 400,000 children has established its safety. Before it was issued for trial, it was thoroughly tested by animal inoculation and by tissue culture methods. Further, tests on each lot were conducted in three laboratories. Every possible precaution was taken to assure safety before any vaccine was used in the trial.

A second factor of fundamental importance is the ability of the vaccine to produce antibodies when injected into children. Tests in monkeys had indi-

cated that satisfactory titres of antibodies were obtained when three injections of vaccine were given at suitable intervals.

Although no statement has been made by the evaluation committee, either in regard to the safety of the vaccine or its antigenicity as measured by serological testing, it can be concluded that the vaccine is safe and it is believed that satisfactory antibody titres are being obtained.

It has not yet been established that a high titre of antibodies implies protection against poliomyelitis. It is the purpose of the large-scale trial to determine whether the children receiving the vaccine are protected against the disease. The measure of the antibody responses will afford valuable information which later may permit a correlation between antibody titres and protection. The value of the vaccine can be determined only when all the data are assembled and studied. Of necessity, this will require an extended period of observation.

A third fundamental consideration is the stability of the vaccine. Extensive studies are being made of vaccines stored under various conditions and for varying periods. It is known that the vaccine should be stored in a refrigerator to prevent deterioration.

In Canada, provision is being made for the preparation of sufficient vaccine for a reasonable trial, which is to be undertaken next spring. For a number of years the Connaught Medical Research Laboratories prepared a large part of the culture fluids of poliomyelitis viruses which were used by pharmaceutical manufacturers in the United States in the preparation of the vaccine. It was possible, therefore, for the Laboratories to undertake the preparation of the vaccine on behalf of the Federal and Provincial Departments of Health. It has been planned that each Provincial Department of Health will receive a proportionate share of the vaccine and will arrange for the trial.

In the present state of knowledge, the steps which have been taken by the Federal and Provincial Departments of Health are wise. The trials in the various Provinces will afford valuable information and, if the results are satisfactory, will make possible the general use of the vaccine. If the results in the United States are disappointing or inconclusive, the Federal and Provincial Departments of Health will be in a position to modify or discontinue their plans and the commitment for the vaccine will be a minimum. It is to be hoped that the Canadian public will understand that it is not practical or wise to prepare vaccine for general use until its value has been established. On the other hand, it is a reasonable and proper procedure for the Federal and Provincial Departments to undertake a trial of the vaccine.

The National Foundation for Infantile Paralysis Inc., New York, has made a tremendous contribution through its program for the care and treatment of poliomyelitis patients throughout the United States. The planning and support of research has been an outstanding part of the program. The distribution and large-scale trial of gamma globulin made possible the evaluation of this product as a means for the modification or prevention of poliomyeltis. As a result of research work, supported by the National Foundation, a preventive vaccine has been made possible and a nation-wide trial undertaken, the results of which will be assessed by an expert committee. Appreciation of the contribution of the National Foundation is evidenced by the generous support accorded it by the people of the United States.

NEWS

British Columbia

TWO NEW HEALTH CENTRES, at Oliver and at Nanaimo, were officially opened in September by the Minister of Health and Welfare, the Hon. Eric Martin. The Oliver Health Centre Association, consisting of representatives of service clubs and other organizations, assumed responsibility for getting the building constructed, and raised some $4,100 locally. Grants of $4,100 each from the Provincial and Federal Governments provided the necessary funds for construction. The Oliver Health Centre, which contains a general office, nurses' examining rooms, clinic rooms, a dispensary, and an assembly room, will serve as a sub-office of the South Okanagan Health Unit, with headquarters at Kelowna, and will be the centre of public health activities for some 8,000 people in the Oliver area.

The Nanaimo Health Centre is one of the few centres which allow all official and voluntary health agencies in the area to be housed under one roof. It provides headquarters, clinic, and working space for the staff of the Central Vancouver Island Health Unit, and storage facilities, committee-rooms, and an auditorium for use by all health organizations in Nanaimo. Cost of the $84,000 health centre was met by the Provincial and Federal Governments, with contributions of $15,000 each; by the City of Nanaimo, which contributed $20,000; and by donations from industries, health agencies, and community groups.

MR. C. E. BRADBURY has been appointed Provincial Rehabilitation Co-ordinator for British Columbia under the terms of an agreement between the Provincial Government and the Federal Department of Labour. Responsible directly to the Deputy Minister of Health, Mr. Bradbury has been selected to develop a plan which will co-ordinate the rehabilitation services of public and private agencies working with disabled persons. His headquarters will be in the Health Branch offices, Victoria. In conducting his program, Mr. Bradbury will be concerned with vocational training, placement services, and the services provided under the Department of National Health and Welfare's Medical Rehabilitation Grant. Mr. Bradbury has been actively engaged in rehabilitation work since 1947 when he was appointed rehabilitation director for the B.C. Tuberculosis Society. Since 1949, he has served as rehabilitation officer with the Division of Tuberculosis Control, B.C. Provincial Department of Health and Welfare.

AN ATTEMPT was made to carry out a pilot study to determine whether there was any indication of different food habits between edentulous persons and persons with artificial dentures. The study was carried out among persons 65 years of age or over and in receipt of Social Assistance. Social workers obtained diet records covering a period of seven consecutive days from 21 persons who were without teeth and from 44 persons who used artificial dentures. The number for whom it was possible to obtain diet records was considerably less than originally planned, and because of the smallness of the final sample only limited observations could be made. The study gave no appreciable indication that any significant difference exists in the dietary habits of edentulous and dentured persons. The food consumption in both groups was shown to be remarkably similar. The edentulous persons showed a somewhat poorer overall food consumption and a lower consumption of vegetables, particularly raw vegetables. However, since it is possible that these variations were due to chance alone, no firm conclusions can be drawn from them. This study was carried out by the Division of Vital Statistics, Division of Environmental Management (Nutrition Service) and Division of Preventive Dentistry, Victoria, B.C.

Alberta

THE EXECUTIVE of the Alberta Public Health Association met on October 1st to make plans for the forty-third annual meeting of the Canadian Public Health Association, which will be held in the Macdonald Hotel, Edmonton, on September 6, 7 and 8, 1955.

PUBLIC HEALTH WORKERS in Alberta will learn with regret that Dr. M. P. G. Rawlinson has accepted a position with the Division of Occupational Health in the Department of National Health and Welfare, Ottawa. Dr.

Rawlinson has been medical officer of health for the Bow Valley Health Unit and the Mountainview Health Unit, with headquarters at Calgary.

DR. G. M. LITTLE, Medical Officer of Health, Edmonton, has been appointed to succeed Dr. Rawlinson as president of the Alberta Public Health Association.

DR. J. C. MORE has returned to the Red Deer Health Unit as medical officer of health. He formerly held this position but has been in private practice at Red Deer for a few years.

Saskatchewan

FOUR HUNDRED AND THIRTY-FIVE THOUSAND inserts calling attention to career opportunities in the health field went out recently with annual tax notices of the Saskatchewan Hospital Services Plan. The inserts invited inquiry and have come back to the Division of Health Education at an average rate of 80 a day. Inquirers range from 13-year-old high-school students needing vocational guidance to ambitious grandmothers past 60. The bulk have come from young persons genuinely interested in qualifying for one of the 25 listed careers.

Opportunities both in and outside the public service are included. Inquirers are being sent information on the nature of work, qualifications, promotional opportunities, and salaries.

The Division of Health Education was invited several years ago to employ its facilities in personnel recruiting, the purpose being to find staff for immediate needs and to create a continuing flow of eligible candidates for future needs. At this time psychiatric institutions are fully staffed with qualified personnel and an eligible list has been established. Recruitment of candidates for the general nursing profession has matched the capacity of training schools.

THE SASKATCHEWAN BRANCH of the Canadian Public Health Association was organized last spring and it now has a campaign for membership under way. Very shortly, a brochure describing the organization and its objectives will be sent out to all those who are actively engaged in public health work, with an invitation to join the association. The annual meeting of the association will be held in Regina next spring. The program committee has prepared a tentative program and is presently contacting competent persons to prepare papers.

FLUORIDATION—Residents of Regina and Saskatoon will decide by plebiscites on November 3 if the two cities are to have fluoridated water. The plebiscites were ordered by the city councils after petitions were presented to them by the anti-fluoridationists.

The Department of Public Health is presently engaging in an educational campaign for fluoridation by meetings, radio, television, newspaper advertisements, special articles literature, and films.

Fluoridation of water has been recommended by the Saskatchewan Dental Association, the Saskatchewan Hospital Association, the executive of the Saskatchewan Branch of the Canadian Public Health Association, the executive of the Saskatchewan Federation of Home and School Associations, the Saskatchewan Medical Association, and the Saskatchewan division of the Health League of Canada.

Manitoba

HOSPITAL ADMINISTRATORS and Trustees from the four western provinces attended their ninth annual Institute at Winnipeg, September 27 to October 1. The institute was held this year in conjunction with the Manitoba Hospital and Nursing Conference. Nine provincial organizations, including the Manitoba Public Health Association and other groups with professional, technical or administrative connections, conferred separately and together during the five-day meeting. The Hon. F. C. Bell, Minister of Health and Public Welfare, addressed the opening session and Mayor Garnet Coulter brought greetings from the City.

DR. E. J. RIGBY, chief health inspector for the city of Winnipeg, was elected president of the Manitoba Public Health Association at the Hospital and Nursing Conference. Dr. Rigby, who will serve on the executive with Miss Jessie Williamson, first vice-president, Dr. William Watt, second vice-president, and Miss Josephine DeBrincat, secretary-treasurer, succeeds Dr. J. N. Scatliff.

OF 11,081 MANITOBA CHILDREN from 17 areas slated to take part in the Salk poliomyelitis vaccine trials this summer 5,840 completed the three inoculations. Giving a preliminary report on the field trials, Dr. C. C. Wright, assistant epidemiologist, Manitoba Department of Health, told the Manitoba Public Health Association that

63% of the eligible children in Manitoba received parental consent, compared to 93% in Nova Scotia and 60% in the United States.

The belated offer to Canada to take part in the trials was made because a surplus of materials existed after the United States experiment. Because of the severity of the epidemics in 1952 and 1953, Manitoba decided to enter the field trials, Dr. Wright felt.

The trials have taken place in 44 States and in three Canadian provinces—Manitoba, Nova Scotia and Alberta.

Manitoba reported 100 cases of poliomyelitis from January 1 to September 11, 1954, as compared to 1,479 cases in the same period in 1953.

DR. H. R. STEWART, speaking to the medical health officers section of the Manitoba Public Health Association, strongly approved water fluoridation as a preventive of tooth decay among children. Dr. Stewart is director of dental health services for the Manitoba government.

In Manitoba communities, such as St. Pierre, that have natural fluoride in the water, Dr. Stewart said children do not have more than one or two cavities. "If there are more, a question will assure you that the child is a new arrival in the municipality or from an outlying area that has no fluorides in the water."

Dr. Stewart also said that St. Malo and DuFrost, which were formerly supplied with water from St. Pierre, have recently dug their own wells where water does not contain much fluorine, and that dental work in these schools has increased considerably.

Speaking on the public resistance to fluoridation, Dr. Stewart pointed out that considerable indignation was also offered when chlorine was first introduced into drinking water as a preventive of typhoid fever. The addition of iodine to table salt for the prevention of goitre was similarly opposed.

Dr. Earl Rutledge was elected chairman of the medical health officer's section and Dr. J. A. Eadie was elected secretary.

FOLLOWING THE ELECTION of Miss W. M. Barratt as chairman and Miss Josephine De Brincat as secretary, the Nursing Section of the M.P.H.A. was addressed by Dr. C. A. Little, Assistant Medical Superintendent, Psychopathic Hospital, on "Mental Hygiene and the Public Health Nurse." Dr. Little emphasized that the establishment of a good relationship with a patient was the first step towards helping him. To do this the nurse must give the patient a feeling of security. "The outstanding impression I get in most of my cases is the patient's insecurity. They are overwhelmed by their problems, feeling indecisive and frustrated. I don't think anything means more to a patient than the security that comes from talking to someone who is interested, understanding and anxious to help." Dr. Little warned against becoming too perfectionist and idealistic. "That only makes *us* feel secure," he said. It is important to face the patient's problem realistically."

L. A. KAY, director of the Manitoba Bureau of Public Health Engineering, who was recently elected president of the Western Canada Water and Sewage Conference said, in an address to the Environmental Hygiene Section of the M.P.H.A.: "Both the public's health and our natural resources are jeopardized as long as stream pollution goes unchecked." A panel representing the medical profession, conservation experts and engineers discussed various aspects of the problem.

This section's new slate of officers includes William Ward, chairman, David Graham, vice-chairman, and Walter Noyes, secretary.

AMONG THOSE elected to office at the annual meeting in September of the Western Canada Water and Sewage Conference at Regina is W. J. Ducharme, public health engineer with the Manitoba Department Health and Public Welfare.

TWO HEALTH UNITS in the Province have announced an extension of their services. The rural municipality of Lac du Bonnet and the village of Lac du Bonnet are now included in the Selkirk Health Unit and the Laboratory and X-Ray Unit. As of October the Virden Health Unit includes the rural municipalities of Hamiota and Lansdowne and the village of Hamiota. The St. James—St. Vital—Fort Garry Health Unit has expanded to include the rural municipality of Charleswood.

DR. V. S. HAWKES, director of the Selkirk Health Unit for the past four years, has resigned his post and left Manitoba for British Columbia. Dr. Hawkes will work with the Federal Department of Citizenship and Immigration there.

DR. J. E. A. PATERSON, M.B., Ch.B., D.M.R.D., arrived last month to join the Manitoba Department of Health and Public Welfare as radiologist. Dr. Paterson, who was born in Ayrshire, Scotland, studied at the Universities of Glasgow and London. After his service with the R.A.M.C. from 1941 to 1946, mainly in North Africa, he

returned to Glasgow as radiologist at the Sick Children's Hospital.

In 1949 Dr. Paterson left for Perth, Australia, where for a year he was radiolcgist at the Sick Children's Hospital. He left the country to do radiolcgical work with the Australian Immigration Scheme in Italy. For the past three years, Dr. Paterson has worked at the Western Infirmary at Glasgow, first as senior registrar in radiology and then as senior hospital medical officer.

Ontario

TWO NEW ONTARIO GOVERNMENT publications, "Hospitalization Mcrbidity Study" and a "Guide to Hospital Building in Ontario", were released recently for publication by the Hon. Mackinnon Phillips, M.D., Minister of Health.

The Morbidity Study is the result of three years' work directed by George D. Davis, who was chairman of the Ontario Health Survey Committee.

The census year 1951 was selected for the survey in order that the findings might be related to the population. The study involved an analysis of the discharges and deaths in the public general hospitals of the province during 1951, numbering 645,313 patients; the 15,434 patients remaining in hospital at the end of 1951; the patients treated in convalescent hospitals, chronic sections of public general hospitals and in hospitals for incurables (now known as hospitals for the chronically ill)—a grand total of 668,036 patients.

It does not include the patients in the Ontario (mental) Hospitals, sanatoria for tuberculous patients, private hospitals or nursing homes. These were dealt with in the Report of the Ontario Health Survey Committee.

The "Guide to Hospital Building in Ontario" is a comprehensive bcok containing up-to-date material for the use of architects and others interested in hospital planning. It was prepared by a committee of experts headed by Professor Eric Arthur and much advice was given by architects, builders and public health officials.

THE HONOURABLE MACKINNON PHILLIPS, M.D., C.M., recently received an honorary LL.D. degree in a special ceremony at Queen's University, Kingston. The convocation marked the centenary of Queen's Faculty of Medicine.

"WAY OF RETURN", the Ontario Department of Health's latest motion picture, has been shown with success at the Owen Sound Industrial Fair and the International Plowing Match. First shown at this year's Canadian National Exhibition, the 15-minute colour film depicts phases of treatment given an emotionally disturbed mental-hospital patient. Scenes were taken at the Ontario Hospital, St. Thomas. This film is available on request from the Publicity Division, Room 5434, Department of Health, Parliament Buildings, Toronto.

MR. JAMES GIBBARD, M.Sc., director of the Laboratory of Hygiene in the Department of National Health and Welfare, Ottawa, has been awarded a WHO fellowship. During the next eight months he will visit hospitals and research institutions in the United Kingdom and Europe in order to study services and programs.

Quebec

DR. ALLEN W. FREEMAN died recently at the Johns Hopkins Hospital, Baltimore, after an illness of several months. In the early 20's he visited this Province and conducted a survey of the general sanitary conditions, as consultant to the Rockefeller Foundation. He was responsible for the planning of the county health units program in this Province.

A distinguished gentleman of the old school, Dr. Freeman brought to the fulfilment of his duties a likable disposition and a concern for public welfare which combined to earn for him the esteem and affection of his colleagues. Quiet spoken, unruffled and scholarly, conscientious and diligent, he was a man of strength and dependability to all who came in contact with him.

Dr. Freeman's death severs a bond of personal friendship as well of official relationship with the Officers of the Ministry of Health, and is a loss to all public health workers in North America.

Prince Edward Island

DR. OWEN CURTIS, Deputy Minister of Health, attended the meeting of the Dominion Council of Health in Ottawa. While in Ontario he also visited Toronto.

DR. BURTON HOWATT (D.P.H. '54) joined the Department of Health as health officer, assisting Dr. Curtis, on August 23rd.

THIS YEAR Prince Edward Island was again visited by an epidemic of poliomyelitis, mainly confined to the middle and eastern end of the Province. Up to the middle of October there were 73 cases with four deaths.

EMPLOYMENT SERVICE

Research Assistant, male or female, for virus research department. Vacancy November 1st. Salary according to experience. Previous experience in bacteriology desirable. Apply to Dr. A. J. Rhodes, Director, Research Institute, The Hospital for Sick Children, 555 University Avenue, Toronto. 9–10

Assistant Medical Officer of Health: Applications are invited for the appointment of Assistant Medical Officer of Health in the Township of Scarborough. Salary $6,000 to $10,000 per annum, subject to adjustments according to experience. Submit requests for information to Dr. C. D. Farquharson, Medical Officer of Health, Township of Scarborough, and submit applications to Mr. C. A. Tripp, Clerk, Township of Scarborough. The mailing address for both is 2001 Eglinton Avenue East, Postal Station "H", Toronto 13, Ontario. 8-10

Public Health Nurse for generalized program in Prince Edward County Health Unit. Initial salary $2,600. Allowance for experience. Employee benefits include: Blue Cross, Pension Plan, Sick Leave, one month vacation. Workmen's Compensation. Liberal transportation allowance. Apply to A. M. Breuls, M.D., Director, Prince Edward County Health Unit, Picton, Ontario. 8–10

Public Health Nurses required immediately by Red Deer Health Unit. Diploma in public health nursing required. Duties to commence as soon as possible. Salary range $2,250 to $3,120; allowance made for experience when assessing starting salary. Car provided. Applications to Secretary, No. 9 (Red Deer) Health Unit, Red Deer, Alberta, with full details of qualifications and experience. 8–10

Sanitary Inspector required for generalized program with the Bruce County Health Unit. Minimum salary $2,700 with allowance for experience. Pension and Blue Cross plans available. Car Allowance 9¢ per mile. Apply to T. H. Alton, Secretary-Treasurer, Bruce County Health Unit, Walkerton, Ontario. 9–11

Nurse to direct Public Health Nursing program for Health Department of City of Calgary. Preference given to person holding degree or certificate in Public Health Nursing with administrative and supervisory experience. 5-day week. Sick leave and pension plan. 1 month holiday after 1 year. Car provided. State salary expected. Apply Dr. W. H. Hill, City Health Department, Calgary, Alberta. 9–10

The Stony Plain—Lac Ste. Anne Health Unit No. 17, near EDMONTON, Alberta, requires a registered nurse with public health qualifications to start immediately. Minimum salary $2,640. and increments $140. x 3 and $260. x 1. Starting salary by arrangement. Applications stating qualifications to the Director of the Health Unit, STONY PLAIN, Alberta. 10